

General

Guideline Title

ACR Appropriateness Criteria® chronic hip pain.

Bibliographic Source(s)

Mintz DN, Roberts CC, Bencardino JT, Baccei SJ, Caird M, Cassidy RC, Chang EY, Fox MG, Gyftopoulos S, Kransdorf MJ, Metter DF, Morrison WB, Rosenberg ZS, Shah NA, Small KM, Subhas N, Tambar S, Towers JD, Yu JS, Weissman BN, Expert Panel on Musculoskeletal Imaging. ACR Appropriateness Criteria® chronic hip pain. Reston (VA): American College of Radiology (ACR); 2016. 16 p. [106 references]

Guideline Status

This is the current release of the guideline.

This guideline updates a previous version: Taljanovic MS, Daffner RH, Weissman BN, Appel M, Arnold E, Bancroft LW, Bennett DL, Blebea JS, Bruno MA, Fries IB, Hayes CW, Kransdorf MJ, Luchs JS, Morrison WB, Palestro CJ, Roberts CC, Stoller DW, Tuite MJ, Ward RJ, Wise JN, Zoga AC, Expert Panel on Musculoskeletal Imaging. ACR Appropriateness Criteria® chronic hip pain. [online publication]. Reston (VA): American College of Radiology (ACR); 2011. 9 p. [89 references]

This guideline meets NGC's 2013 (revised) inclusion criteria.

Recommendations

Major Recommendations

ACR Appropriateness Criteria®

Clinical Condition: Chronic Hip Pain

Variant 1: Chronic hip pain. First test.

| Radiologic Procedure | Rating | Comments | RRL* |
|--------------------------------------|--------|---|-------|
| X-ray pelvis | 9 | X-ray pelvis and x-ray hip are complementary. | ⊕ ⊕ |
| X-ray hip | 9 | X-ray pelvis and x-ray hip are complementary. | ⊕ ⊕ ⊕ |
| MRI hip without IV contrast | 1 | | ○ |
| MRI hip without and with IV contrast | 1 | | ○ |
| US hip | 1 | | ○ |

| Radiologic Procedure | Rating | Comments | RRL* |
|---|--------|----------|----------------------------------|
| CT hip without IV contrast | 1 | | ☢☢☢ |
| CT hip with IV contrast | 1 | | ☢☢☢ |
| CT hip without and with IV contrast | 1 | | ☢☢☢ |
| CT arthrography hip | 1 | | ☢☢☢ |
| MR arthrography hip | 1 | | O |
| Tc-99m bone scan hip | 1 | | ☢☢☢ |
| F-18 fluoride PET hip | 1 | | ☢☢☢ |
| Image-guided anesthetic +/- corticosteroid injection hip joint or surrounding structures | 1 | | Varies |
| Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate | | | *Relative Radiation Level |

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 2: Chronic hip pain. Radiographs negative, equivocal or nondiagnostic. Suspect extra-articular noninfectious soft-tissue abnormality, such as tendonitis.

| Radiologic Procedure | Rating | Comments | RRL* |
|---|--------|----------|----------------------------------|
| MRI hip without IV contrast | 9 | | O |
| US hip | 7 | | O |
| Image-guided anesthetic +/- corticosteroid injection hip joint or surrounding structures | 5 | | Varies |
| MRI hip without and with IV contrast | 3 | | O |
| MR arthrography hip | 2 | | O |
| CT hip without IV contrast | 1 | | ☢☢☢ |
| CT hip with IV contrast | 1 | | ☢☢☢ |
| CT hip without and with IV contrast | 1 | | ☢☢☢ |
| CT arthrography hip | 1 | | ☢☢☢ |
| Tc-99m bone scan hip | 1 | | ☢☢☢ |
| F-18 fluoride PET hip | 1 | | ☢☢☢ |
| Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate | | | *Relative Radiation Level |

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 3: Chronic hip pain. Radiographs negative, equivocal, or nondiagnostic. Suspect impingement.

| Radiologic Procedure | Rating | Comments | RRL* |
|--|--------|---|--------|
| MRI hip without IV contrast | 8 | | O |
| MR arthrography hip | 8 | | O |
| CT arthrography hip | 7 | | ☢☢☢ |
| CT hip without IV contrast | 5 | | ☢☢☢ |
| Image-guided anesthetic +/- corticosteroid injection hip joint or surrounding structures | 5 | This procedure is often done at the same time as MR or CT arthrography. | Varies |

| Radiologic Procedure | Rating | Comments | RRL* |
|---|--------|----------|----------------------------------|
| US hip | 4 | | O |
| MRI hip without and with IV contrast | 3 | | O |
| CT hip with IV contrast | 1 | | ☢☢☢ |
| CT hip without and with IV contrast | 1 | | ☢☢☢ |
| Tc-99m bone scan hip | 1 | | ☢☢☢ |
| F-18 fluoride PET hip | 1 | | ☢☢☢ |
| Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate | | | *Relative Radiation Level |

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 4: Chronic hip pain. Radiographs negative, equivocal or nondiagnostic. Suspect labral tear with or without clinical findings consistent with or suggestive of impingement.

| Radiologic Procedure | Rating | Comments | RRL* |
|---|--------|---|----------------------------------|
| MR arthrography hip | 9 | | O |
| CT arthrography hip | 7 | | ☢☢☢ |
| MRI hip without IV contrast | 6 | | O |
| MRI hip without and with IV contrast | 5 | | O |
| Image-guided anesthetic +/- corticosteroid injection hip joint or surrounding structures | 5 | This procedure is often done at the same time as MR or CT arthrography. | Varies |
| CT hip without IV contrast | 1 | | ☢☢☢ |
| CT hip with IV contrast | 1 | | ☢☢☢ |
| CT hip without and with IV contrast | 1 | | ☢☢☢ |
| US hip | 1 | | O |
| Tc-99m bone scan hip | 1 | | ☢☢☢ |
| F-18 fluoride PET hip | 1 | | ☢☢☢ |
| Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate | | | *Relative Radiation Level |

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 5: Chronic hip pain. Evaluate articular cartilage. Next test after radiographs.

| Radiologic Procedure | Rating | Comments | RRL* |
|---|--------|---|------------------|
| MRI hip without IV contrast | 9 | | O |
| MR arthrography hip | 9 | | O |
| CT arthrography hip | 8 | | ☢☢☢ |
| MRI hip without and with IV contrast | 5 | | O |
| Image-guided anesthetic +/- corticosteroid injection hip joint or surrounding structures | 4 | This procedure is often done at the same time as MR or CT arthrography. | Varies |
| CT hip without IV contrast | 1 | | ☢☢☢ |
| CT hip with IV contrast | 1 | | ☢☢☢ |
| CT hip without and with IV contrast | 1 | | ☢☢☢ |
| Rating Scale: 1.2.3 Usually not appropriate: 4.5.6 May be appropriate: 7.8.9 Usually appropriate | | | *Relative |

| Radiologic Procedure | Rating | Comments | RRL* |
|---|--------|----------|----------------------------------|
| US hip | | | O |
| Tc-99m bone scan hip | | | ☼☼☼ |
| F-18 fluoride PET hip | 1 | | ☼☼☼ |
| Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate | | | *Relative Radiation Level |

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.




Variant 6: Chronic hip pain. Radiographs positive. Arthritis of uncertain type. Infection is a consideration.

| Radiologic Procedure | Rating | Comments | RRL* |
|---|--------|---|----------------------------------|
| MRI hip without and with IV contrast | 9 | | O |
| Aspiration hip | 9 | | Varies |
| MRI hip without IV contrast | 7 | | O |
| US hip | 5 | | O |
| Tc-99m 3-phase bone scan hip | 4 | This procedure is performed with SPECT/CT and labeled white blood cell imaging. | ☼☼☼ |
| CT hip without IV contrast | 2 | | ☼☼☼ |
| CT hip with IV contrast | 2 | | ☼☼☼ |
| CT hip without and with IV contrast | 2 | | ☼☼☼ |
| F-18 fluoride PET hip | 2 | | ☼☼☼ |
| CT arthrography hip | 1 | | ☼☼☼ |
| MR arthrography hip | 1 | | O |
| Image-guided anesthetic +/- corticosteroid injection hip joint or surrounding structures | 1 | | Varies |
| Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate | | | *Relative Radiation Level |

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.



















Variant 7: Chronic hip pain. Radiographs suggestive of pigmented villonodular synovitis or osteochondromatosis.

| Radiologic Procedure | Rating | Comments | RRL* |
|---|--------|----------|----------------------------------|
| MRI hip without IV contrast | 9 | | O |
| CT arthrography hip | 5 | | ☼☼☼ |
| Aspiration hip | 4 | | Varies |
| MRI hip without and with IV contrast | 2 | | O |
| US hip | 2 | | O |
| CT hip without IV contrast | 2 | | ☼☼☼ |
| CT hip with IV contrast | 2 | | ☼☼☼ |
| CT hip without and with IV contrast | 2 | | ☼☼☼ |
| MR arthrography hip | 2 | | O |
| Tc-99m bone scan hip | 2 | | ☼☼☼ |
| Image-guided anesthetic +/- corticosteroid injection hip joint or surrounding structures | 1 | | Varies |
| Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate | | | *Relative Radiation Level |

| Radiologic Procedure | Rating | Comments | RRL* |
|---|--------|----------|--|
| F-18 fluoride PET hip | | |    |
| Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate | | | *Relative Radiation Level |
























Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 8: Chronic hip pain and low back, pelvic, or knee pathology. Want to exclude hip as the source. Radiographs negative, equivocal, or showing mild osteoarthritis.

| Radiologic Procedure | Rating | Comments | RRL* |
|---|--------|----------|---|
| MRI hip without IV contrast | 9 | | O |
| Image-guided anesthetic +/- corticosteroid injection hip joint or surrounding structures | 8 | | Varies |
| CT hip without IV contrast | 5 | |    |
| MR arthrography hip | 5 | | O |
| US hip | 4 | | O |
| MRI hip without and with IV contrast | 2 | | O |
| CT arthrography hip | 2 | |    |
| CT hip with IV contrast | 1 | |    |
| CT hip without and with IV contrast | 1 | |    |
| Tc-99m bone scan hip | 1 | |    |
| F-18 fluoride PET hip | 1 | |    |
| Rating Scale: 1,2,3 Usually not appropriate; 4,5,6 May be appropriate; 7,8,9 Usually appropriate | | | *Relative Radiation Level |

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 9: Computer navigation of hip arthroplasty or modeling.

| Radiologic Procedure | Rating | Comments | RRL* |
|--|--------|----------|---|
| CT hip without IV contrast | 9 | |    |
| X-ray pelvis | 1 | |   |
| X-ray hip | 1 | |    |
| MRI hip without IV contrast | 1 | | O |
| MRI hip without and with IV contrast | 1 | | O |
| US hip | 1 | | O |
| CT hip with IV contrast | 1 | |    |
| CT hip without and with IV contrast | 1 | |    |
| CT arthrography hip | 1 | |    |
| MR arthrography hip | 1 | | O |
| Tc-99m bone scan hip | 1 | |    |
| F-18 fluoride PET hip | 1 | |    |
| Image-guided anesthetic +/- corticosteroid injection hip joint or surrounding structures | 1 | | Varies |

| Rating Scale Radiologic Procedure | 1,2,3 Usually not appropriate | 4,5,6 May be appropriate | 7,8,9 Usually appropriate | Comments | *Relative Radiation Level |
|--------------------------------------|-------------------------------|--------------------------|---------------------------|----------|------------------------------|
| | | | | | |

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Summary of Literature Review

Introduction/Background

Chronic hip pain and/or groin pain is a perplexing clinical problem. Symptoms may be related to numerous etiologies, including trauma, neoplasms, and arthropathies. Pain may be due to osseous, intra-articular, periarticular, or soft-tissue pathology. Referred pain from the lumbar spine, sacroiliac joints, or knee may add to the potentially confusing clinical picture. Very few references deal specifically with chronic hip pain, although the imaging of specific disorders has been the subject of many articles and case reports.

Clinical data are essential for selecting the most appropriate imaging techniques in patients with chronic hip pain. A targeted history and physical examination, including provocative maneuvers, range of motion, gait abnormalities, locking or snapping, duration of symptoms, and pain patterns (e.g., worse at night and relieved by aspirin typical of osteoid osteoma, or steroid use as a cause of osteonecrosis [ON]) can be very useful for reducing the potentially long list of differential diagnoses. Similar attention must be paid to the knees and spine as potential sources of pain.

Overview of Imaging Modalities

Obtaining radiographs is a good first step to screen hip pain. They may provide specific information for common disorders such as arthritis or less common disorders such as bone tumors. In many instances, such as osteoarthritis (OA) or advanced ON, they may be the only imaging necessary. The progression through the imaging armamentarium is not sequential and depends on the appearance of the radiographs and the suspected diagnosis.

After radiographs, imaging modalities include computed tomography (CT), magnetic resonance imaging (MRI), ultrasound (US), and nuclear medicine testing (bone scan and positron emission tomography [PET]). CT and MRI are tomographic techniques that lend themselves to the creation of 3-D images, which are useful to define the complex bony anatomy of the hip.

MRI and CT can be performed with contrast, either injected intravenously or intra-articularly. Intravenous (IV) contrast is generally used to evaluate soft tissues and aid or enhance the imaging contrast between vascular and nonvascular tissues. For example, a vascular tumor may be more readily visible on a CT scan with IV contrast.

With time, intravenously injected MRI contrast also leaks into the hip joint, creating an arthrographic image (so-called indirect arthrography). Contrast in the joint from indirect arthrography is also used in delayed gadolinium-enhanced MRI of cartilage (dGEMRIC), a technique of ultrastructural cartilage imaging. Other techniques of ultrastructural imaging on MRI such as T2 mapping and T1rho do not require IV contrast.

Direct arthrography creates images with a lot of imaging contrast between the articular surfaces of the joint and the contrast agent, allowing detection of defects in articular cartilage, labrum, and capsule and outlining structures in the joint, such as synovitis or cartilaginous bodies. The use of intra-articular contrast is somewhat controversial, with some radiology centers strongly preferring or avoiding its use. When arthrography is performed, a simultaneous intra-articular injection of anesthetic and/or steroid can provide diagnostic information and be therapeutic, as further discussed below.

US is a noninvasive, user-dependent technique, free of ionizing radiation, that can be used to evaluate specific questions about superficial structures, such as the abductor tendons for tendinosis or calcific bursitis, as well as deeper structures such as the iliopsoas and adductor tendons. It is also useful for guiding injections. US may reliably diagnose most anterior acetabular labral tears, although some authors do not find US as sensitive as CT arthrography.

The nuclear medicine study is primarily the bone scan, in which injected radioactive material goes to areas of active bone turnover. The classic bone scan is performed using a radioactive technetium-labeled bisphosphonate (technetium Tc-99m methylene diphosphonate [MDP]). Variations include multiple phases of image acquisition, local or whole-body acquisitions, and tomographic acquisitions using single-photon emission computed tomography (SPECT) or SPECT/CT. Another agent that can go to bone is radioactive sodium fluoride-18 (¹⁸F-fluoride) and the bone scan using that agent uses PET, yielding ¹⁸F-fluoride PET. This is in distinction to fluorine-18-2-fluoro-2-deoxy-D-glucose (FDG)-PET, more often used in brain, cardiac, and tumor imaging. Fluoride-18 PET can be used interchangeably with Tc-99m MDP bone scan.

Injections of anesthetic, with or without corticosteroids, are often used as a diagnostic test to distinguish the source of pain. An intra-articular injection relieving pain suggests that the pain is coming from the joint. Similarly, trochanteric pain may be relieved by trochanteric injection and

iliopsoas pain by iliopsoas injection. Joint aspirations with fluid examination/culture can exclude joint infections. These injections/aspirations should be guided by imaging.

Discussion of Imaging Modalities by Variant

Variant 1: Chronic Hip Pain. First Test

Depending on history and physical examination, imaging may not be necessary to evaluate all hip pain. A directed examination with a particular suspected problem may direct more specific targeted imaging (e.g., US for abductor tendinosis/trochanteric bursitis or spine imaging for referred pain).

Radiographs should be obtained first in most, if not all, cases and may provide specific information for common disorders such as arthritis or less common disorders such as primary bone tumors. This is opinion or dogma without good scientific evidence. For certain disorders, such as dysplasia or femoroacetabular impingement (FAI), specialized views such as the false profile or a Dunn view can provide more detailed evaluation of the anatomy. Radiography is an excellent screening tool. For many disorders, a view of the pelvis and additional image of the proximal femur is better than radiographs limited to the ipsilateral hip. Whether the radiographs are normal or not, they are often of considerable value for the selection of additional imaging techniques and for comparison with studies such as MRI, CT, radionuclide bone scans, and ¹⁸F-fluoride PET.

For OA, a common entity, physical examination and radiography may be better than MRI and have reasonable sensitivity and specificity.

Aspiration and injection are not currently performed until a diagnosis is suspected.

Variant 2: Chronic Hip Pain. Radiographs Negative, Equivocal, or Nondiagnostic. Suspect Extra-articular Noninfectious Soft-tissue Abnormality, Such as Tendonitis

Soft tissues are best evaluated on MRI and US. CT is less sensitive for soft-tissue evaluation.

MRI is frequently performed after initial radiographs to detect osseous and soft-tissue abnormalities. It is both highly sensitive and specific for detecting many abnormalities involving the surrounding soft tissues and should, in general, be the first imaging technique used following radiographs. MRI is useful for examining surrounding soft-tissue entities such as iliopsoas or subiliacus bursitis, athletic pubalgia, trochanteric bursitis, abductor tendinosis/tears, calcific tendonitis, and hamstring injuries and for sources of referred pain from spine or knee. Some secondary signs may suggest snapping hip syndrome (coxa saltans).

Other causes of a chronically painful hip for which MRI has been used with considerable success include acute and chronic soft-tissue injuries, inflammation, and tumors. IV gadolinium chelate agents or US can be used to differentiate between joint fluid and synovitis. IV contrast is rarely needed for MRI.

US can be used to localize fluid collections, such as paralabral cysts, for aspiration and injection. US can also be used to evaluate snapping hip.

Other techniques such as fluoroscopic motion studies (with or without contrast) and US are useful to evaluate periarticular conditions such as snapping iliopsoas tendon and extra-articular impingements. One study group used real-time US to evaluate the snapping iliopsoas tendon. This method is noninvasive, which is an advantage compared with injection of the tendon sheath and fluoroscopic evaluation.

Diagnostic and therapeutic injections are safe and useful tools for confirming the location of pain and, in some cases, helping in its control for a short period.

Trochanteric and iliopsoas bursal/peritendinous injections may be useful in determining the cause of hip pain. Aspiration is also critical in diagnosing the presence of crystal disease.

Nuclear medicine does not currently play a role in the workup of these conditions.

Variant 3: Chronic Hip Pain. Radiographs Negative, Equivocal, or Nondiagnostic. Suspect Impingement

Osseous abnormalities are often evident on radiographs (incidence unverified), but cross-sectional imaging is more sensitive for many abnormalities. Intrinsic bony abnormalities include fracture, ON, and tumor. MRI is sensitive and specific. Further specific discussions about metastatic disease and stress fractures are presented in other American College of Radiology (ACR) Appropriateness Criteria® documents (see below). Scintigraphy is sensitive but not specific. Image-guided injections have a role in distinguishing between intra-articular and extra-articular abnormalities but not in further evaluating a suspected bone abnormality. Intra-articular injections can be performed, sometimes at the time of arthrography. If pain is relieved, the pathology is felt to be intra-articular.

Arthrography is for intra-articular abnormalities. US is limited in its evaluation of bone and cannot evaluate abnormalities deep to the cortex.

Dynamic US can be useful to look for extra-articular impingements. CT is an excellent tool, but abnormalities are not as evident as they are on MRI, and tissue characterization is less robust.

In the presence of normal radiographs and in the absence of ready access to MRI, a bone scan using ^{18}F -fluoride PET or radionuclide bone scans are effective for detecting or excluding subtle osseous abnormalities. The bone scan can be performed using SPECT to improve sensitivity and can be combined with CT or MRI.

Extrinsic bony pathology includes dysplasia and the impingement syndromes—both intra-articular (FAI) and extra-articular (ischio pelvic, ischio trochanteric, subspinous, and femoropelvic). MRI and CT arthrography are useful for evaluating articular cartilage and labrum. Hip cartilage abnormalities also can be successfully evaluated by high-resolution CT arthrography or digital tomosynthesis (x-ray tomography).

With appropriate operator expertise, US may reliably diagnose most anterior acetabular labral tears, although some authors do not find US as sensitive as CT arthrography. CT is additionally used, especially preoperatively, in assessing bony anatomy in the setting of FAI and dysplasia. Three-dimensional reconstructions based on CT and MRI are an accurate tool for quantifying the femoral head-neck morphology for providing a noninvasive assessment of hips at risk of FAI. Software programs can use CT and MRI data to create models of the hip that allow motion analysis for assessing impingements. CT data are also used in computer navigation of arthroplasty. CT, MRI, and US can be useful to evaluate extra-articular impingements.

Variant 4: Chronic Hip Pain. Radiographs Negative, Equivocal, or Nondiagnostic. Suspect Labral Tear with or without Clinical Findings Consistent with or Suggestive of Impingement

For evaluating labral tears, MRI with or without arthrography can be used. Direct MR arthrography with the intra-articular injection of a dilute (1:200) solution of gadolinium chelate in saline has been established as a reliable technique for diagnosing acetabular labral tears that are frequently associated with FAI and may be an effective tool in assessing acetabular cartilage delamination. However, several investigators suggest that high-resolution 3T MRI may improve the visualization of the acetabular labrum and the hyaline articular cartilage, which may obviate the need for intra-articular contrast. Ultrastructural cartilage imaging may prove to be useful to determine potential timing of surgery or whether surgery would be appropriate for FAI. One of these techniques (dGEMRIC) requires IV contrast administration and exercising the patient.

Other investigators have obtained satisfactory results in detecting labral and hyaline cartilage lesions with high-resolution MRI of the hip at 1.5T without intra-articular contrast. Indirect MR arthrography, in which gadolinium chelate contrast is administered by IV injection and diffuses into the joint space through the synovium, has been proposed as an alternative to direct MR arthrography for detecting intra-articular disorders. It is faster and easier to perform than direct arthrography and does not require fluoroscopy. It suffers from less consistent enhancement of the joint space as well as inability to distend the joint capsule. Its accuracy in assessing the hyaline articular cartilage and the acetabular labrum of the hip is uncertain. Some centers include radial imaging or radial reconstructions on CT and/or MRI to evaluate the shape of the femoral neck.

MR arthrography in overall published data is superior to CT arthrography and noncontrast MRI for evaluation of labral tears. However, in some articles, CT arthrography and noncontrast MRI fare better. CT arthrography has been shown to be better than MRI for chondral lesions. FAI has components that are intra-articular and extra-articular. Although no studies support it, surgeons may use both MRI and CT in order to define the joint (labrum and articular cartilage) and the bone. Measurements can be performed on radiography, CT, and MRI.

Although not the modality of choice in evaluating labral pathology and FAI, radiotracer uptake in the superior or superomedial aspect of the acetabular rim on skeletal scintigraphy has been reported as a characteristic feature of a labral tear. Absence of this pattern carries a high negative predictive value for the diagnosis. Focal radiotracer uptake on SPECT images localized to the superolateral acetabular rim and/or anterolateral femoral head-neck junction shows a moderate sensitivity and specificity in diagnosis of FAI.

Diagnostic joint injections are safe and useful tools for confirming the etiology of pain (such as labral tear). US can also be used to localize paralabral cysts for aspiration and injection. It is not as sensitive as other modalities for detecting labral tears.

Variant 5: Chronic Hip Pain. Evaluate Articular Cartilage. Next Test after Radiographs

Direct visualization of articular cartilage is possible using those imaging techniques that provide either intrinsic contrast (MRI and US) or extrinsic contrast (any type of arthrography). Different methods of chondral imaging are possible on routine MRI and there are ultrastructural techniques (T2 mapping, T1 rho, dGEMRIC, sodium imaging) that are mostly used for research. MRI, MR arthrography, and CT arthrography can all give excellent delineation of articular cartilage. Grading systems for cartilage are primarily used for research.

The use of IV contrast except as used for indirect MR arthrography or dGEMRIC imaging does not help to delineate articular cartilage. It may help to evaluate synovitis. US is limited in the hip by its inability to evaluate the acetabular or the majority of the femoral head cartilage. The acoustic window to see articular cartilage in the hip is limited. Nuclear medicine techniques (bone scan and PET) are not useful for cartilage imaging.

Intra-articular anesthetic/steroid injections can be performed, sometimes at the time of arthrography, as a diagnostic/therapeutic tool rather than to evaluate articular cartilage directly.

Variant 6: Chronic Hip Pain. Radiographs Positive. Arthritis of Uncertain Type. Infection Is a Consideration

A rheumatologic evaluation may be appropriate, including bloodwork and evaluation for other areas of abnormality, perhaps with bone scan or ^{18}F -fluoride PET. The best way to exclude septic arthritis is by joint aspiration. MRI is a noninvasive option. In the pediatric population, where debridement will be performed, US may be used to identify the effusion before joint aspiration or surgery. If an infectious etiology leads to chronic pain, less aggressive organisms must be considered. Tuberculous septic arthritis has been diagnosed with FDG-PET imaging, but this is not typical.

Although CT scan can demonstrate erosions and enthesophytes before radiography, it has not been shown to specifically evaluate infection. As in Variant 8, it can be used to evaluate soft-tissue calcifications.

Variant 7: Chronic Hip Pain. Radiographs Suggestive of Pigmented Villonodular Synovitis or Osteochondromatosis

Other intra-articular sources of pain such as synovitis, whether inflammatory (e.g., Lyme disease), proliferative (e.g., synovial chondromatosis), or neoplastic (e.g., chondroma), are well demonstrated on MRI. It can be quite difficult to tell pigmented villonodular synovitis from synovial chondromatosis and other proliferative synovial processes. CT might help to look for calcifications. MRI including a gradient-echo sequence may be useful. The diagnosis may require a tissue sample.

Nuclear medicine does not currently play a role in the workup of these conditions.

Image-guided aspiration/injections demonstrate brown or bloody aspirate in patients with the diffuse form of pigmented villonodular synovitis. CT, MR, or x-ray arthrography can be useful to determine if a body is intra-articular.

Variant 8: Chronic Hip Pain and Low Back, Pelvic, or Knee Pathology. Want to Exclude Hip as the Source. Radiographs Negative, Equivocal, or Showing Mild Osteoarthritis

After radiography, MRI is the best next test to screen the hip for significant pathology.

As described in Variant 2, direct injections can be used to assess if pain is related to the hip.

As described in Variant 2, US is useful to examine soft-tissue structures around the hip for specific diagnoses such as trochanteric bursitis.

Nuclear medicine does not currently play a role in the workup of these conditions. CT is more sensitive than radiographs at evaluating joint space narrowing but has not been shown to have a role for this indication.

Variant 9: Computer Navigation of Hip Arthroplasty or Modeling

CT data can be used to guide computer-navigated surgery. This CT is only for navigation, determining exact anatomy and position of instruments at the time of surgery. Such a CT is not for diagnosis but is prescribed using specifications defined by device companies to guide computer-navigated surgery. CT and MRI data can also be used to make 3-D models of bony anatomy and to create custom prostheses. Cross-sectional data from CT or MRI can also be used to perform virtual surgery. Models can allow one to define the parameters of bony resection and do the surgery on the computed model. Models can also pair with computer-assisted surgery, for example, resect a cam lesion in FAI according to a prescribed plan. This is different from templating arthroplasties, for which one uses radiographs.

The Food and Drug Administration is considering an application from a company that uses MRI for modeling. MRI will likely be able to be used for this indication in the near future.

Other modalities such as radiographs and nuclear medicine techniques do not play a role in modeling.

Injections are not used for this indication.

Other Diagnoses

Since chronic hip pain can have many etiologies, the causes are covered in more than 1 of the appropriateness criteria documents. Diagnoses covered in other topics are as follows:

Metastatic bone disease is covered in the National Guideline Clearinghouse (NGC) summary of the ACR Appropriateness Criteria® [Metastatic bone disease](#).

Stress fractures are covered in the NGC summary of the ACR Appropriateness Criteria® [Stress \(fatigue/insufficiency\) fracture, including sacrum, excluding other vertebrae](#).

Bone tumors, including osteoid osteomas, are covered in the NGC summary of the ACR Appropriateness Criteria® [Primary bone tumors](#).

Atypical femur fracture associated with bisphosphonate, if it is not apparent on radiography, is examined in the NGC summary of the ACR Appropriateness Criteria® [Osteoporosis and bone mineral density](#).

ON is covered in the NGC summary of the ACR Appropriateness Criteria® [Osteonecrosis of the hip](#).

Summary of Recommendations

- Radiographs of the pelvis and hip should be the first test ordered for the evaluation of patients with chronic hip pain.
- MRI hip without IV contrast or US hip is appropriate in patients with chronic hip pain when radiographs are negative, equivocal, or nondiagnostic and there is suspicion for an extra-articular noninfectious soft-tissue abnormality such as tendonitis.
- MRI hip without IV contrast, MR arthrography, or CT arthrography is appropriate in patients with chronic hip pain when radiographs are negative, equivocal, or nondiagnostic and there is a suspicion for impingement.
- MR arthrography or CT arthrography is appropriate in patients with chronic hip pain when radiographs are negative, equivocal, or nondiagnostic and a labral tear is suspected.
- MRI hip without IV contrast, MR arthrography, or CT arthrography is appropriate after radiographs in patients with chronic hip pain to evaluate articular cartilage.
- MRI hip with or without IV contrast or hip aspiration is appropriate after positive radiographs in patients with chronic hip pain with suspected arthritis when infection is a consideration.
- MRI hip without IV contrast is appropriate in patients with chronic hip pain when radiographs are suggestive of pigmented villonodular synovitis or osteochondromatosis.
- MRI hip without IV contrast image-guided anesthetic with or without corticosteroid is appropriate to exclude the hip as the source of pain in patients with chronic hip pain and low back, pelvic, or knee pathology with negative or equivocal radiographs or radiographs showing mild osteoarthritis. CT hip without contrast is the preferred modality for computer-navigated surgery.

Abbreviations

- CT, computed tomography
- F-18, fluoride-18
- IV, intravenous
- MR, magnetic resonance
- MRI, magnetic resonance imaging
- PET, positron emission tomography
- SPECT, single-photon emission computed tomography
- Tc-99m, technetium-99 metastable
- US, ultrasound

Relative Radiation Level Designations

| Relative Radiation Level* | Adult Effective Dose Estimate Range | Pediatric Effective Dose Estimate Range |
|---------------------------|-------------------------------------|---|
| O | 0 mSv | 0 mSv |
| ☼ | <0.1 mSv | <0.03 mSv |
| ☼ ☼ | 0.1-1 mSv | 0.03-0.3 mSv |
| ☼ ☼ ☼ | 1-10 mSv | 0.3-3 mSv |
| ☼ ☼ ☼ ☼ | 10-30 mSv | 3-10 mSv |
| ☼ ☼ ☼ ☼ ☼ | 30-100 mSv | 10-30 mSv |

*RRL assignments for some of the examinations cannot be made, because the actual patient doses in these procedures vary as a function of a number of factors (e.g., region of the body exposed to ionizing radiation, the imaging guidance that is used). The RRLs for these examinations are designated as "Varies."

Clinical Algorithm(s)

Algorithms were not developed from criteria guidelines.

Scope

Disease/Condition(s)

Chronic hip pain

Guideline Category

Diagnosis

Evaluation

Clinical Specialty

Family Practice

Internal Medicine

Neurology

Nuclear Medicine

Oncology

Orthopedic Surgery

Radiology

Rheumatology

Intended Users

Advanced Practice Nurses

Health Care Providers

Health Plans

Hospitals

Managed Care Organizations

Physician Assistants

Physicians

Students

Utilization Management

Guideline Objective(s)

To evaluate the appropriateness of imaging procedures for patients with chronic hip pain

Target Population

Patients with chronic hip pain

Interventions and Practices Considered

1. X-ray
 - Pelvis
 - Hip
2. Magnetic resonance imaging (MRI), hip
 - Without intravenous (IV) contrast
 - Without and with IV contrast
3. MR arthrography, hip
4. Ultrasound (US), hip
5. Computed tomography (CT), hip
 - Without IV contrast
 - With IV contrast
 - Without and with IV contrast
6. CT arthrography, hip
7. Technetium (Tc)-99m bone scan, hip
8. Tc-99m 3-phase bone scan, hip
9. F-18 fluoride positron emission tomography (FDG-PET), hip
10. Image-guided anesthetic +/- corticosteroid injection, hip joint or surrounding structures
11. Aspiration, hip

Major Outcomes Considered

- Utility of imaging modalities in evaluating patients with chronic hip pain
- Sensitivity, specificity, and diagnostic accuracy of imaging modalities in evaluating patients with chronic hip pain

Methodology

Methods Used to Collect/Select the Evidence

Hand-searches of Published Literature (Primary Sources)

Hand-searches of Published Literature (Secondary Sources)

Searches of Electronic Databases

Description of Methods Used to Collect/Select the Evidence

Literature Search Summary

Of the 89 citations in the original bibliography, 57 were retained in the final document.

A literature search was conducted in July 2013, June 2015, May 2016, and June 2016 to identify additional evidence published since the *ACR Appropriateness Criteria® Chronic Hip Pain* topic was finalized. Using the search strategies described in the literature search companion (see the "Availability of Companion Documents" field), 4883 articles were found. Thirty-five articles were added to the bibliography. One thousand four

hundred ninety-two articles were not used as they were duplicates already cited in the original bibliography or captured in more than one literature search. The remaining articles were not used due to either poor study design, the articles were not relevant or generalizable to the topic, or the results were unclear or biased.

The author added 9 citations from bibliographies, Web sites, or books that were not found in the literature searches.

Five citations are supporting documents that were added by staff.

See also the American College of Radiology (ACR) Appropriateness Criteria® literature search process document (see the "Availability of Companion Documents" field) for further information.

Number of Source Documents

Of the 89 citations in the original bibliography, 57 were retained in the final document. The literature search conducted in July 2013, June 2015, May 2016, and June 2016 identified 35 articles that were added to the bibliography. The author added 9 citations from bibliographies, Web sites, or books that were not found in the literature searches. Five citations are supporting documents that were added by staff.

Methods Used to Assess the Quality and Strength of the Evidence

Weighting According to a Rating Scheme (Scheme Given)

Rating Scheme for the Strength of the Evidence

Definitions of Study Quality Categories

Category 1 - The study is well-designed and accounts for common biases.

Category 2 - The study is moderately well-designed and accounts for most common biases.

Category 3 - The study has important study design limitations.

Category 4 - The study or source is not useful as primary evidence. The article may not be a clinical study, the study design is invalid, or conclusions are based on expert consensus.

The study does not meet the criteria for or is not a hypothesis-based clinical study (e.g., a book chapter or case report or case series description);

Or

The study may synthesize and draw conclusions about several studies such as a literature review article or book chapter but is not primary evidence;

Or

The study is an expert opinion or consensus document.

Category M - Meta-analysis studies are not rated for study quality using the study element method because the method is designed to evaluate individual studies only. An "M" for the study quality will indicate that the study quality has not been evaluated for the meta-analysis study.

Methods Used to Analyze the Evidence

Review of Published Meta-Analyses

Systematic Review with Evidence Tables

Description of the Methods Used to Analyze the Evidence

The topic author assesses the literature then drafts or revises the narrative summarizing the evidence found in the literature. American College of Radiology (ACR) staff drafts an evidence table based on the analysis of the selected literature. These tables rate the study quality for each article included in the narrative.

The expert panel reviews the narrative, evidence table and the supporting literature for each of the topic-variant combinations and assigns an appropriateness rating for each procedure listed in the variant table(s). Each individual panel member assigns a rating based on his/her interpretation of the available evidence.

More information about the evidence table development process can be found in the ACR Appropriateness Criteria® Evidence Table Development document (see the "Availability of Companion Documents" field).

Methods Used to Formulate the Recommendations

Expert Consensus (Delphi)

Description of Methods Used to Formulate the Recommendations

Rating Appropriateness

The American College of Radiology (ACR) Appropriateness Criteria (AC) methodology is based on the RAND Appropriateness Method. The appropriateness ratings for each of the procedures or treatments included in the AC topics are determined using a modified Delphi method. A series of surveys are conducted to elicit each panelist's expert interpretation of the evidence, based on the available data, regarding the appropriateness of an imaging or therapeutic procedure for a specific clinical scenario. The expert panel members review the evidence presented and assess the risks or harms of doing the procedure balanced with the benefits of performing the procedure. The direct or indirect costs of a procedure are not considered as a risk or harm when determining appropriateness. When the evidence for a specific topic and variant is uncertain or incomplete, expert opinion may supplement the available evidence or may be the sole source for assessing the appropriateness.

The appropriateness is represented on an ordinal scale that uses integers from 1 to 9 grouped into three categories: 1, 2, or 3 are in the category "usually not appropriate" where the harms of doing the procedure outweigh the benefits; and 7, 8, or 9 are in the category "usually appropriate" where the benefits of doing a procedure outweigh the harms or risks. The middle category, designated "may be appropriate," is represented by 4, 5, or 6 on the scale. The middle category is when the risks and benefits are equivocal or unclear, the dispersion of the individual ratings from the group median rating is too large (i.e., disagreement), the evidence is contradictory or unclear, or there are special circumstances or subpopulations which could influence the risks or benefits that are embedded in the variant.

The ratings assigned by each panel member are presented in a table displaying the frequency distribution of the ratings without identifying which members provided any particular rating. To determine the panel's recommendation, the rating category that contains the median group rating without disagreement is selected. This may be determined after either the first or second rating round. If there is disagreement after the first rating round, a conference call is scheduled to discuss the evidence and, if needed, clarify the variant or procedure description. If there is disagreement after the second rating round, the recommendation is "May be appropriate."

This modified Delphi method enables each panelist to articulate his or her individual interpretations of the evidence or expert opinion without excessive influence from fellow panelists in a simple, standardized, and economical process. For additional information on the ratings process see the [Rating Round Information](#) document.

Additional methodology documents, including a more detailed explanation of the complete topic development process and all ACR AC topics can be found on the [ACR Web site](#) (see also the "Availability of Companion Documents" field).

Rating Scheme for the Strength of the Recommendations

Not applicable

Cost Analysis

A formal cost analysis was not performed and published cost analyses were not reviewed.

Method of Guideline Validation

Internal Peer Review

Description of Method of Guideline Validation

Criteria developed by the Expert Panels are reviewed by the American College of Radiology (ACR) Committee on Appropriateness Criteria.

Evidence Supporting the Recommendations

Type of Evidence Supporting the Recommendations

The recommendations are based on analysis of the current medical evidence literature and the application of the RAND/UCLA appropriateness method and expert panel consensus.

Summary of Evidence

Of the 106 references cited in the *ACR Appropriateness Criteria® Chronic Hip Pain* document, 5 are categorized as therapeutic references including 3 good-quality studies. Additionally, 98 references are categorized as diagnostic references including 2 well-designed studies, 16 good-quality studies, and 18 quality studies that may have design limitations. There are 64 references that may not be useful as primary evidence. There are 3 references that are meta-analysis studies.

Although there are references that report on studies with design limitations, 21 well-designed or good-quality studies provide good evidence.

Benefits/Harms of Implementing the Guideline Recommendations

Potential Benefits

Selection of appropriate radiologic imaging procedures for diagnosis and evaluation of patients with chronic hip pain

Potential Harms

Relative Radiation Level Information

Potential adverse health effects associated with radiation exposure are an important factor to consider when selecting the appropriate imaging procedure. Because there is a wide range of radiation exposures associated with different diagnostic procedures, a relative radiation level (RRL) indication has been included for each imaging examination. The RRLs are based on effective dose, which is a radiation dose quantity that is used to estimate population total radiation risk associated with an imaging procedure. Patients in the pediatric age group are at inherently higher risk from exposure, both because of organ sensitivity and longer life expectancy (relevant to the long latency that appears to accompany radiation exposure). For these reasons, the RRL dose estimate ranges for pediatric examinations are lower as compared to those specified for adults. Additional information regarding radiation dose assessment for imaging examinations can be found in the American College of Radiology (ACR) Appropriateness Criteria® Radiation Dose Assessment Introduction document (see the "Availability of Companion Documents" field).

Qualifying Statements

Qualifying Statements

- An American College of Radiology (ACR) Committee on Appropriateness Criteria and its expert panels have developed criteria for determining appropriate imaging examinations for diagnosis and treatment of specified medical condition(s). These criteria are intended to

guide radiologists, radiation oncologists, and referring physicians in making decisions regarding radiologic imaging and treatment. Generally, the complexity and severity of a patient's clinical condition should dictate the selection of appropriate imaging procedures or treatments. Only those exams generally used for evaluation of the patient's condition are ranked. Other imaging studies necessary to evaluate other co-existent diseases or other medical consequences of this condition are not considered in this document. The availability of equipment or personnel may influence the selection of appropriate imaging procedures or treatments. Imaging techniques classified as investigational by the U.S. Food and Drug Administration (FDA) have not been considered in developing these criteria; however, study of new equipment and applications should be encouraged. The ultimate decision regarding the appropriateness of any specific radiologic examination or treatment must be made by the referring physician and radiologist in light of all the circumstances presented in an individual examination.

- ACR seeks and encourages collaboration with other organizations on the development of the ACR Appropriateness Criteria through society representation on expert panels. Participation by representatives from collaborating societies on the expert panel does not necessarily imply individual or society endorsement of the final document.

Implementation of the Guideline

Description of Implementation Strategy

An implementation strategy was not provided.

Institute of Medicine (IOM) National Healthcare Quality Report Categories

IOM Care Need

Living with Illness

IOM Domain

Effectiveness

Identifying Information and Availability

Bibliographic Source(s)

Mintz DN, Roberts CC, Bencardino JT, Baccei SJ, Caird M, Cassidy RC, Chang EY, Fox MG, Gyftopoulos S, Kransdorf MJ, Metter DF, Morrison WB, Rosenberg ZS, Shah NA, Small KM, Subhas N, Tambar S, Towers JD, Yu JS, Weissman BN, Expert Panel on Musculoskeletal Imaging. ACR Appropriateness Criteria® chronic hip pain. Reston (VA): American College of Radiology (ACR); 2016. 16 p. [106 references]

Adaptation

Not applicable: The guideline was not adapted from another source.

Date Released

2016

Guideline Developer(s)

American College of Radiology - Medical Specialty Society

Source(s) of Funding

The American College of Radiology (ACR) provided the funding and the resources for these ACR Appropriateness Criteria®.

Guideline Committee

Committee on Appropriateness Criteria, Expert Panel on Musculoskeletal Imaging

Composition of Group That Authored the Guideline

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Financial Disclosures/Conflicts of Interest

Not stated

Guideline Status

This is the current release of the guideline.

This guideline updates a previous version: Taljanovic MS, Daffner RH, Weissman BN, Appel M, Arnold E, Bancroft LW, Bennett DL, Blebea JS, Bruno MA, Fries IB, Hayes CW, Kransdorf MJ, Luchs JS, Morrison WB, Palestro CJ, Roberts CC, Stoller DW, Tuite MJ, Ward RJ, Wise JN, Zoga AC, Expert Panel on Musculoskeletal Imaging. ACR Appropriateness Criteria® chronic hip pain. [online publication]. Reston (VA): American College of Radiology (ACR); 2011. 9 p. [89 references]

This guideline meets NGC's 2013 (revised) inclusion criteria.

Guideline Availability

Available from the [American College of Radiology \(ACR\) Web site](#) .

Availability of Companion Documents

The following are available:

- ACR Appropriateness Criteria®. Overview. Reston (VA): American College of Radiology; 2015 Oct. 3 p. Available from the [American College of Radiology \(ACR\) Web site](#) .
- ACR Appropriateness Criteria®. Literature search process. Reston (VA): American College of Radiology; 2015 Feb. 1 p. Available from the [ACR Web site](#) .
- ACR Appropriateness Criteria®. Evidence table development. Reston (VA): American College of Radiology; 2015 Nov. 5 p. Available from the [ACR Web site](#) .
- ACR Appropriateness Criteria®. Topic development process. Reston (VA): American College of Radiology; 2015 Nov. 2 p. Available from the [ACR Web site](#) .

- ACR Appropriateness Criteria®. Rating round information. Reston (VA): American College of Radiology; 2015 Apr. 5 p. Available from the [ACR Web site](#) .
- ACR Appropriateness Criteria®. Radiation dose assessment introduction. Reston (VA): American College of Radiology; 2016. 4 p. Available from the [ACR Web site](#) .
- ACR Appropriateness Criteria®. Manual on contrast media. Reston (VA): American College of Radiology; 2016. 128 p. Available from the [ACR Web site](#) .
- ACR Appropriateness Criteria®. Procedure information. Reston (VA): American College of Radiology; 2016 May. 2 p. Available from the [ACR Web site](#) .
- ACR Appropriateness Criteria® chronic hip pain. Evidence table. Reston (VA): American College of Radiology; 2016. 28 p. Available from the [ACR Web site](#) .
- ACR Appropriateness Criteria® chronic hip pain. Literature search. Reston (VA): American College of Radiology; 2016. 4 p. Available from the [ACR Web site](#) .

Patient Resources

None available

NGC Status

This NGC summary was completed by ECRI on May 6, 2001. The information was verified by the guideline developer as of June 29, 2001. This summary was updated by ECRI on November 12, 2004. The information was verified by the guideline developer on December 21, 2004. This summary was updated by ECRI Institute on June 29, 2009. This summary was updated by ECRI Institute on January 13, 2011 following the U.S. Food and Drug Administration (FDA) advisory on gadolinium-based contrast agents. This summary was updated by ECRI Institute on February 28, 2012. This summary was updated by ECRI Institute on March 17, 2017.

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